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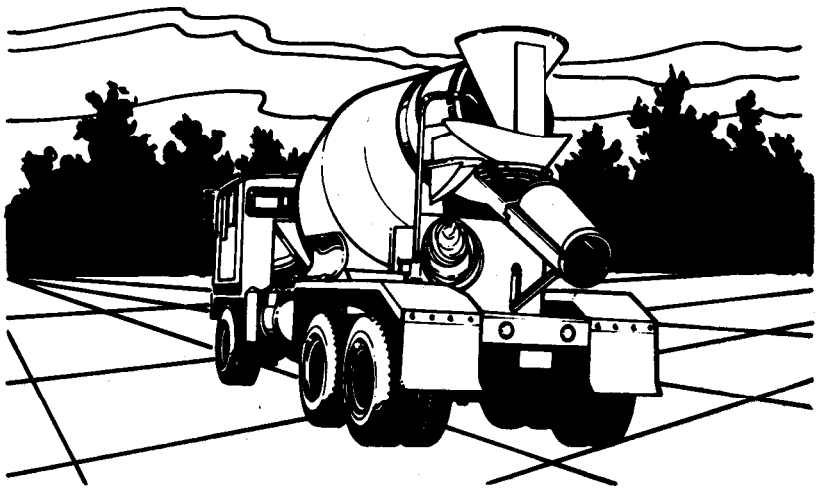

Maintenance & Repair Alternatives Pavement Condition Index (PCI) Field Manual November 1988

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ABSTRACT

This field manual contains distress definition and measuring methods for asphalt surfaced roads and parking lots. These definitions and measuring methods are keyed to the determination of the Pavement Condition Index (PCI). This field manual was written for Engineers, Planners and Estimators, and Inspectors to be used on-site. Total list of field manuals:

No.	Title	Est. Compl. Date
MO-102	Maintenance and Repair of Surfaced Areas	09/89
MO-102.1	Asphalt Surfaced Roads & Parking Lots	04/89
MO-102.2	Jointed Concrete Roads & Parking Lots	04/89
MO-102.3	Asphalt Surfaced Airfields	08/89
MO-102.4	Jointed Concrete Airfields	08/89
MO-102.5	Pavement Maintenance Management	08/90
MO-102.6	Asphalt Crack Repair	12/89
MO-102.7	Concrete Repair	03/90
MO-102.8	Asphalt Repair	12/90

FOREWORD

This field manual contains information on distress definition and measuring methods for jointed concrete roads and parking lots. These definitions and measuring methods are keyed to the determination of the Pavement Condition Index (PCI) that will be explained in Manual, MO-102.5, "Pavements Maintenance Management" (scheduled for August 1990). The pavement condition rating is based on the PCI, which is a numerical indicator based on a scale of 0 to 100. The PCI measures the pavement's structural integrity and surface operational condition. The method presented is intended to accomplish pavement inspection in the most efficient and cost effective manner.

Recommendations or suggestions for modification, or additional information and instruction that will improve the publication and motivate its use, are invited and should be forwarded to the Commander, Naval Facilities Engineering Command (Attention: Code 163), 200 Stovall Street, Alexandria, VA. 22332-2300. Telephone: commercial (202) 325-0045, Autovon 221-0045.

This publication has been reviewed and is approved for certification as an official publication of this Command in accordance with SECNAV Instruction 5600.16.

G.F. EVERHART
CAPT, CEC, US NAVY
Assistant Commander for
Public Works Centers and Departments

TABLE OF CONTENTS

DISTRESS IN JOINTED CONCRETE PAVEMENTS

Nineteen distress types for jointed concrete pavements are listed alphabetically. Distress definitions apply to both plain and reinforced jointed concrete pavements, with the exception of linear cracking distress, which is defined separately for plain and reinforced jointed concrete.

During the field condition surveys and validation of the PCI, several questions were often asked regarding the identification and counting method of some of the distresses. The answers to these questions are included under the section titled “How to Count” for each distress. For convenience, however items that are frequently referenced are listed below.

1. Faulting is counted only at joints. Faulting associated with cracks is not counted separately since faulting is incorporated into the severity-level definitions of cracks. Crack definitions are also used in defining corner breaks and divided slabs.

2. Joint seal damage is not counted on a slab-by-slab basis. Instead, a severity level is assigned based on the overall condition of the joint seal in the area.

3. Cracks in reinforced concrete slabs that are less than 1/8 in. wide are counted as shrinkage cracks. Shrinkage cracks should not be counted to determine if the slab is broken into four or more pieces.

4. If the original distress of a patch is more severe than the patch, the original distress is the distress type recorded. For example, although patch material is present on the scaled area of the slab illustrated in Figure 73, only the scaling is counted.

5. Low-severity scaling (i.e., crazing) should only be counted if there is evidence that future scaling is likely to occur.

6. The severity level of blow-up and railroad distress in jointed concrete pavements is rated according to the distress' effect on ride quality.

The above is not intended to be a complete list. To properly measure each distress type, the inspector must be familiar with its individual criteria.

Figure 73. Distress in jointed concrete pavements

DEFINITIONS OF REPAIR OPTIONS as used in this manual

1. Grinding - Closely spaced diamond blades are used to remove material and provide a smooth surface.

2. Grooving - Patterns are cut into the concrete to reduce hydroplaning and provide skid resistance.

3. Joint Reconstruction - The joint is replaced by resawing the joint after one or both sides of the joint have been patched and/or doweling to provide load transfer.

4. Patching:
   Partial Depth - When the distress effects only the top few inches of the slab, the weakened concrete is removed down to sound concrete and the area patched.

   Full Depth - When the distress extends through the slab the affected area is saw cut and removed down to the base. The base should be recompacted.

5. Seal Cracks - Cracks should be routed to remove any incompressibles before sealing.

6. Underseal - Undersealant, such as cement grout, is inserted by pressure beneath the slab to fill voids and resist future pumping action. It is recommended that load transfer be provided if needed to extend the life of the pavement.

BLOW-UP/BUCKLING

Description: Blow-ups or buckles occur in hot weather, usually at a transverse crack or joint that is not wide enough to permit slab expansion. The insufficient width is usually caused by infiltration of incompressible materials into the joint space. When expansion cannot relieve enough pressure, a localized upward movement of the slab edges (buckling) or shattering will occur in the vicinity of the joint. Blow-ups can also occur at utility cuts and drainage inlets.

Severity Levels:

L - Buckling or shattering causes low-severity ride quality. (Figure 74)

M - Buckling or shattering causes medium-severity ride quality. (Figures 75 and 76)

H - Buckling or shattering causes high-severity ride quality. (Figure 77)

How to Count: At a crack, a blow-up is counted as being in one slab. However, if the blow-up occurs at a joint and affects two slabs, the distress should be recorded as occurring in two slabs. When a blow-up renders the pavement inoperable, it should be repaired immediately.

Options for Repair:

L* - Do nothing; Partial or full depth patch.

M* - Full depth patch; Slab replacement.

H* - Full depth patch; Slab replacement.

• *Must provide expansion joints if patched.*

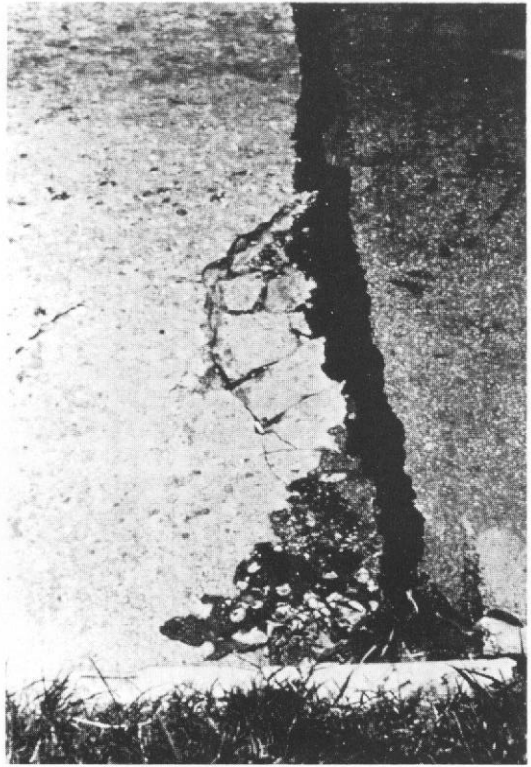

Figure 74. Low-severity blow-up/buckling

Figure 75. Medium-severity blow-up/buckling

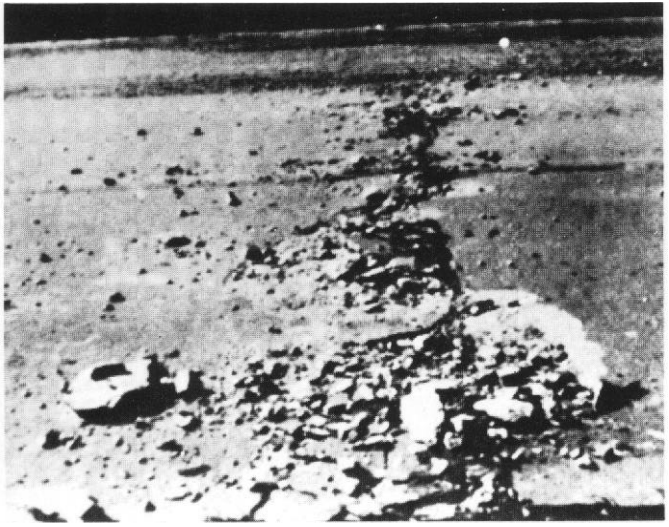

Figure 76. Medium-severity blow-up/buckling

Figure 77. High-severity blow-up/buckling approaching inoperative condition

CORNERBREAK

Description: A corner break is a crack that intersects the joints at a distance less than or equal to one-half the slab length on both sides, measured from the corner of the slab. For example, a slab with dimensions of 12 by 20 ft (3.7 by 6.1 m) that has a crack 5 ft (1.5 m) on one side and 12 ft (3.7 m) on the other side is not considered a corner break; it is a diagonal crack. However, a crack that intersects 4 ft (1.2 m) on one side and 8 ft (2.4 m) on the other is considered a corner break. A corner break differs from a corner spall in that the crack extends vertically through the entire slab thickness, while a corner spall intersects the joint at an angle. Load repetition combined with loss of support and curling stresses usually causes corner breaks.

Severity Levels:

L - Break is defined by a low-severity crack* and the area between the break and the joints is not cracked or may be lightly cracked. (Figures 78 and 79)

M - Break is defined by medium-severity crack* and/or the area between the break and the joints is mediumly cracked. (Figure 80)

H - Break is defined by a high-severity crack* and/or the area between the break and the joints is highly cracked. (Figure 81)

How to Count: Distressed slab is recorded as one slab if it:

1. Contains a single corner break.

2. Contains more than one break of a particular severity.

Corner Break

3. Contains two or more breaks of different severities. For two or more breaks, the highest level of severity should be recorded. For example, a slab containing both low- and medium-severity corner breaks should be counted as one slab with a medium corner break.

'See linear cracking for a definition of low-, medium-, and high-severity cracks.

Options for Repair:

L* - Do nothing; Seal cracks over 1/8 in.

M* - Seal cracks; Full depth patch.

H* - Full depth patch.

**Should check for loss of foundation support or voids under corners. If this exists should consider subsealing and installation of load transfer devices.*

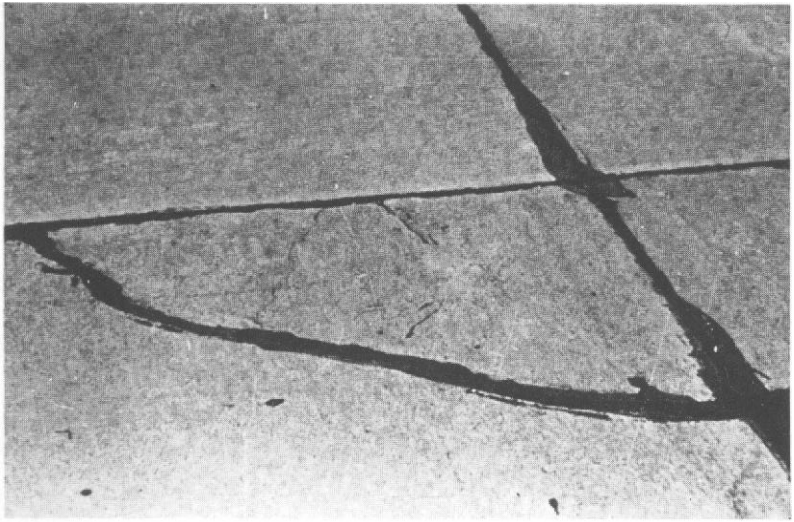

Figure 78. Low-severity corner break

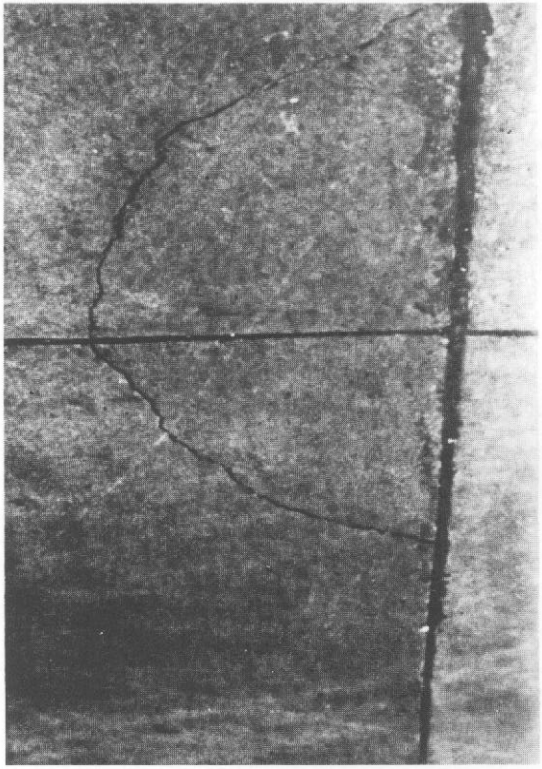

Figure 79. Low-severity corner break

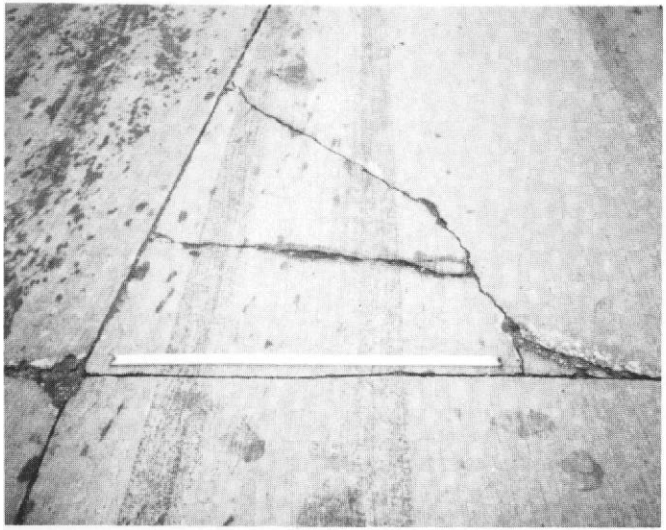

Figure 80. Medium-severity corner break

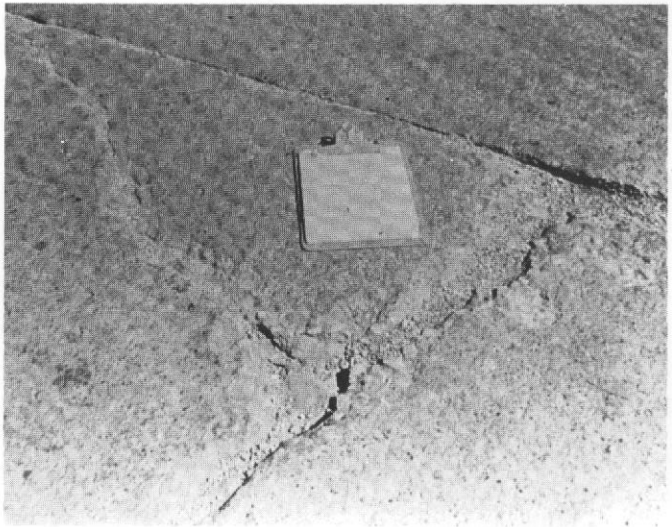

Figure 81. High-severity corner break

DIVIDED SLAB

Description: Slab is divided by cracks into four or more pieces due to overloading and/or inadequate support. If all pieces or cracks are contained within a corner break, the distress is categorized as a severe corner break.

Severity Levels:

Severity of Majority of Cracks	Number of Pieces in Cracked Slab		
	4to5	6to8	More than 8
L	L	L	M
M	M	M	H
H	M	H	H

See Figures 82 through 86.

How to Count: If the slab is medium or high severity, no other distress is counted.

Options for Repair:

L - Do nothing; Seal cracks over 1/8 in.

M - Replace slab.

H - Replace slab.

Figure 82. Low-severity divided slab. Majority of cracks are low severity (less than 1/2 in. wide and no faulting).

Figure 83. Medium-severity divided slab

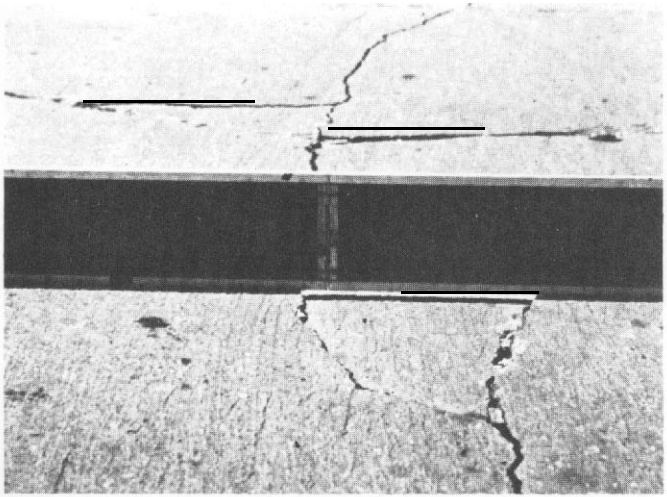

Figure 84. High-severity divided slab caused by high-severity cracks

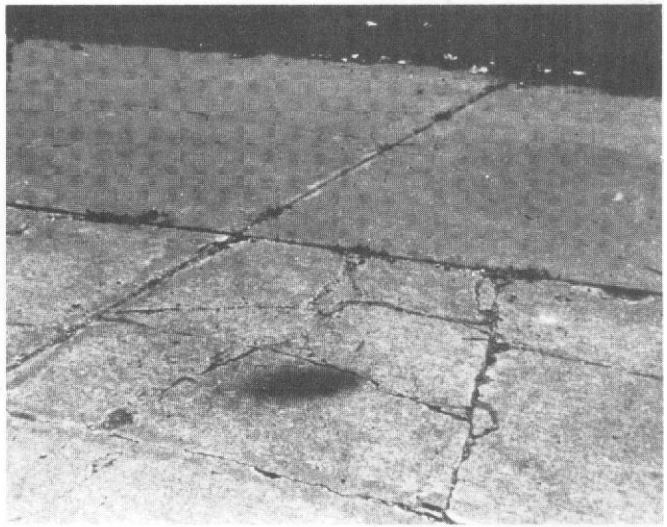

Figure 85. High-severity divided slab

Figure 86. High-severity divided slab

DURABILITY (D) CRACKING

Description: "D" cracking is caused by freeze-thaw expansion of the large aggregate which over time gradually breaks down the concrete. This distress usually appears as a pattern of cracks running parallel and close to a joint or linear crack. Since the concrete becomes saturated near joints and cracks, a dark-colored deposit can usually be found around fine "D" cracks. This type of distress may eventually lead to disintegration of the entire slab.

Severity Levels:

L - "D" cracks cover less than 15 percent of slab area. Most of the cracks are tight, but a few pieces may have popped out. (Figures 87 and 88)

M- One of the following conditions exist (Figure 89):

1. "D" cracks cover less than 15 percent of the area and most of the pieces have popped out or can be easily removed.

2. "D" cracks cover more than 15 percent of the area. Most of the cracks are tight, but a few pieces may have popped out or can be easily removed.

H - "D" cracks cover more than 15 percent of the area and most of the pieces have popped out or can be easily removed. (See Figures 90 and 91)

How to Count: When the distress is located and rated at one severity, it is counted as one slab. If more than one severity level exists, the slab is counted as having the higher severity distress. For example, if low and medium "D" cracking are on the same slab, the slab is counted as medium-severity cracking only.

Options for Repair:

L - Do nothing.

M* - Full depth patch; Reconstruct joints.

H* - Full depth patch; Reconstruct joints; Slab replacement.

**Complete pavement reconstruction may be considered based on economics.*

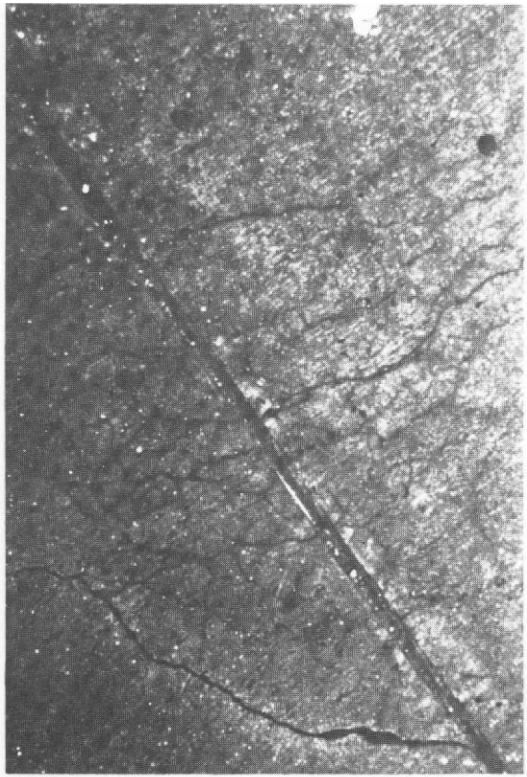

Figure 87. Low-severity durability cracking

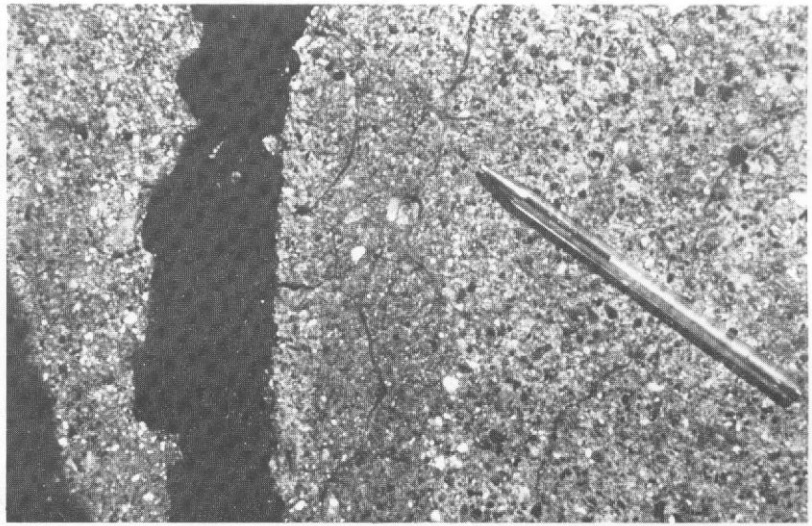

Figure 88. Low-severity durability cracking

Figure 89. Medium-severity durability cracking

Figure 90. High-severity durability cracking

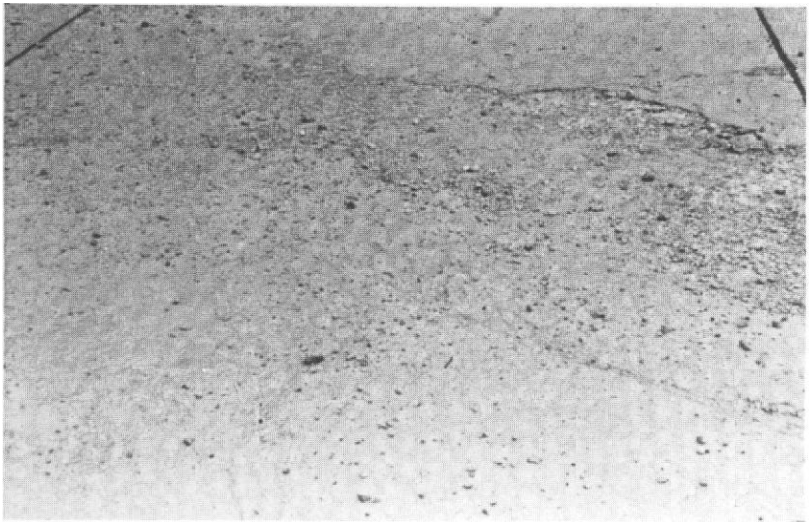

Figure 91. High-severity durability cracking

FAULTING

Description: Faulting is the difference in elevation across a joint. Some of the common causes of faulting are:

1. Settlement because of soft foundation.

2. Pumping or eroding of material from under the slab.

3. Curling of the slabedges due to temperature and moisture changes.

Severity Levels: Severity levels are defined by the difference in elevation across the crack or joint.

Severity Level	Difference in Elevation
L	1/8 to ≤ 3/8 in. (3 to ≤ 10 mm)
M	> 3/8 to ≤ 3/4 in. (> 10 to ≤ 19 mm)
H	> 3/4 in. (> 19 mm)

See Figures 92 through 95.

How to Count: Faulting across a joint is counted as one slab. Only affected slabs are counted.

Faults across a crack are not counted as distress, but are considered when defining crack severity.

Options for Repair:

L* - Do nothing; Grind.

M* - Grind.

H* - Grind.

**If faulting is caused by settlement or loss of support then subsealing and installation of load transfer devices should be considered.*

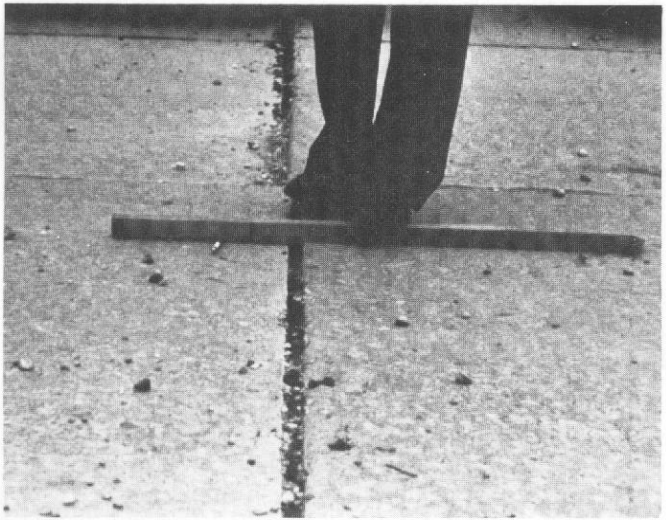

Figure 92. Low-severity faulting

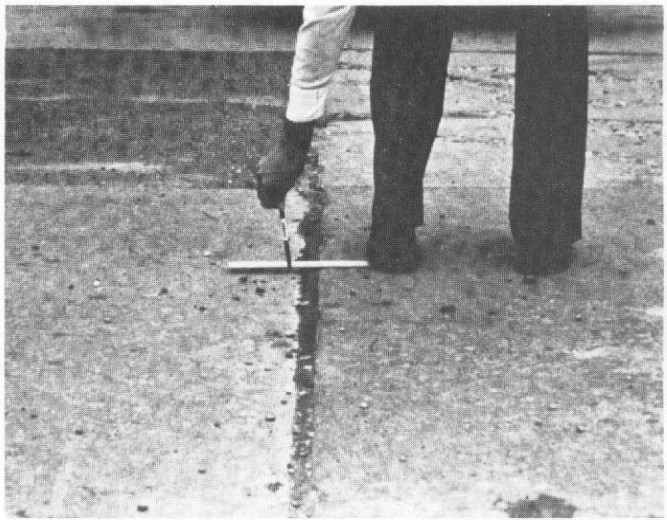

Figure 93. Medium-severity faulting

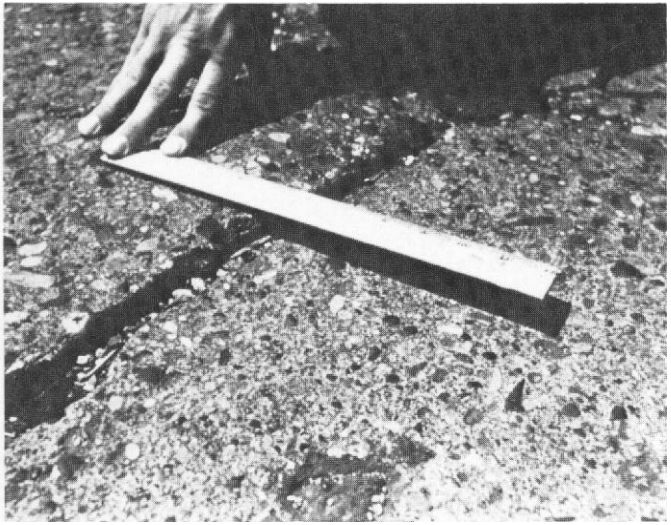

Figure 94. Medium-severity faulting

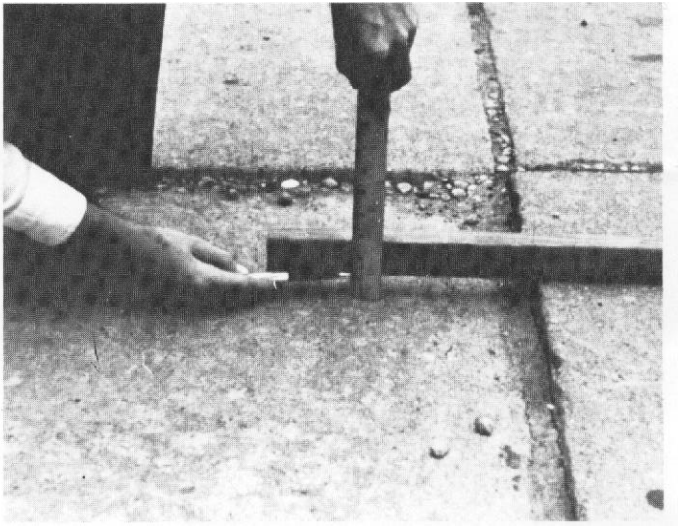

Figure 95. High-severity faulting

JOINT SEAL DAMAGE

Description: Joint seal damage is any condition which enables soil or rocks to accumulate in the joints or allows significant water infiltration. Accumulation of incompressible materials prevents the slabs from expanding and may result in buckling, shattering, or spalling. A pliable joint filler bonded to the edges of the slabs protects the joints from material accumulation and prevents water from seeping down and softening the foundation supporting the slab.

Typical types of joint seal damage are:

1. Stripping of joint sealant.
2. Extrusion of joint sealant.
3. Weed growth.
4. Hardening of the filler (oxidation).
5. Loss of bond to the slab edges.
6. Lack or absence of sealant in the joint.

Severity Levels:

L - Joint sealant is in generally good condition throughout the section. Sealant is performing well, with only minor damage (see above). (Figure 96)

M - Joint sealant is in generally fair condition over the entire section, with one or more of the above types of damage occurring to a moderate degree. Sealant needs replacement within 2 years. (Figure 97)

H - Joint sealant is in generally poor condition over the entire section, with one or more of the above types of damage occurring to a severe degree. Sealant needs immediate replacement. (Figures 98 and 99)

How to Count:

Joint seal damage is not counted on a slab-by-slab basis, but rated based on the overall condition of the sealant over the entire area.

Options for Repair:

L - Do nothing.

M - Reseal joints.

H - Reseal joints.

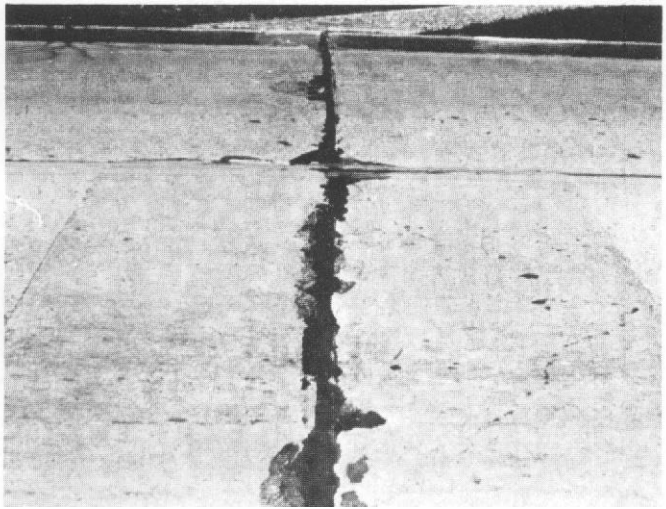

Figure 96. Low-severity joint seal damage

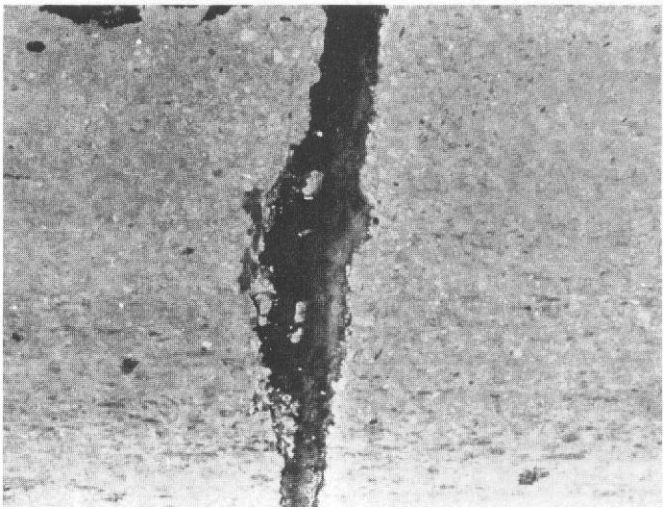

Figure 97. Medium-severity joint seal damage

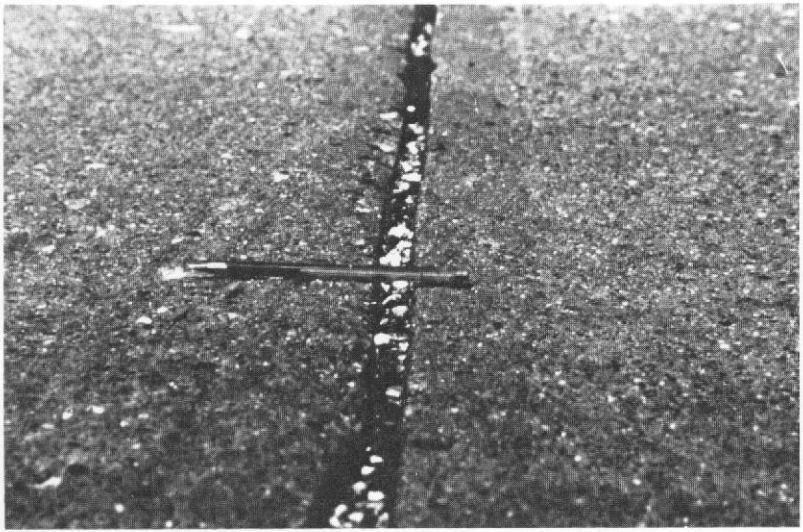

Figure 98. High-severity joint seal damage

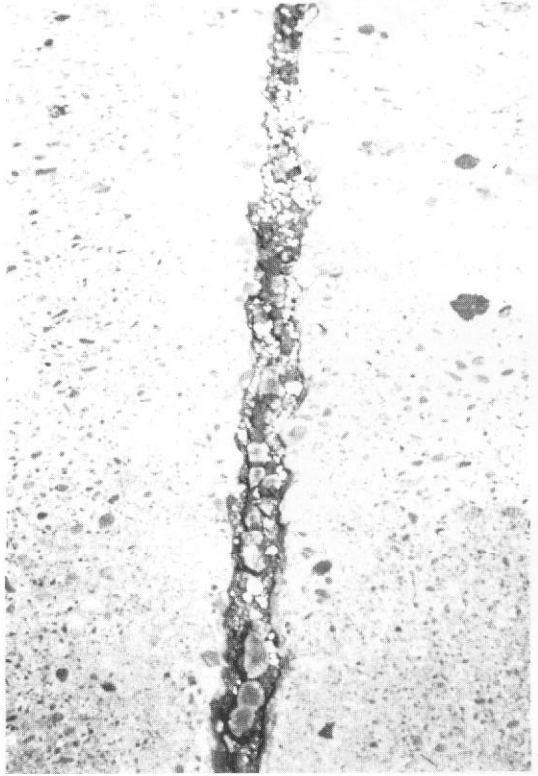

Figure 99. High-severity joint seal damage

LANE/SHOULDER DROP-OFF

Description: Lane/shoulder drop-off is the difference between the settlement or erosion of the shoulder and the pavement travel-lane edge. The elevation difference can be a safety hazard; it can also cause increased water infiltration.

Severity Levels:

L - The difference between the pavement edge and shoulder is 1 to 2 in. (25 to 51 mm). (Figure 100)

M - The difference in elevation is 2 to 4 in. (51 to 102 mm). (Figure 101)

H - The difference in elevation is greater than 4 in. (102 mm). (Figure 102)

How to Count: The mean lane/shoulder drop-off is computed by averaging the maximum and minimum drop along the slab. Each slab exhibiting distress is measured separately and counted as one slab with the appropriate severity level.

Options for Repair: L, M, H - Regrade and fill shoulders to match lane height.

Figure 100. Low-severity lane/shoulder drop off

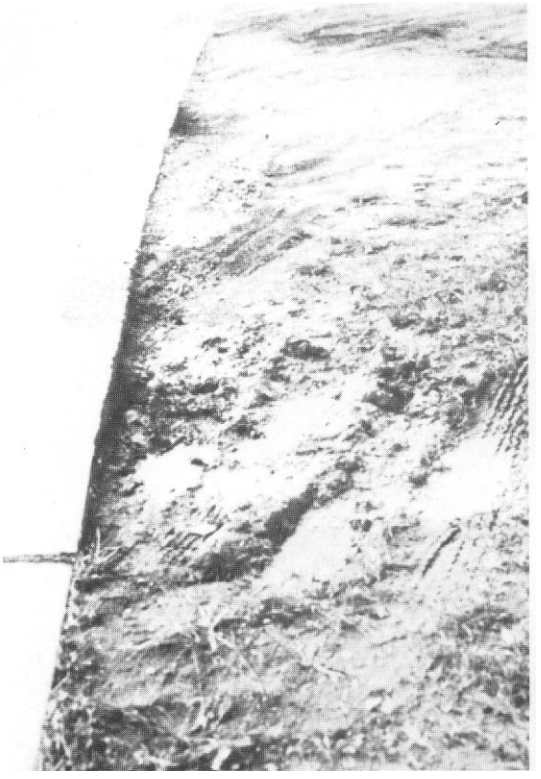

Figure 101. Medium-severity lane/shoulder 37 drop off

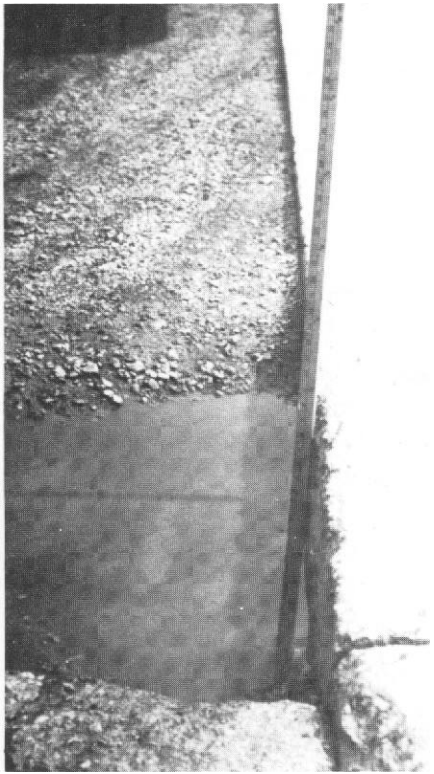

Figure 102. High-severity lane/shoulder drop off

LINEAR CRACKING (LONGITUDINAL, TRANSVERSE, AND DIAGONAL CRACKS)

Description: These cracks, which divide the slab into two or three pieces, are usually caused by a combination of repeated traffic loading, thermal gradient curling, and repeated moisture loading. (Slabs divided into four or more pieces are counted as Divided Slabs.) Low-severity cracks are usually related to warp or friction and are not considered major structural distresses. Medium- or high-severity cracks are usually working cracks and are considered major structural distresses. (Figures 103 through 108)

Hairline cracks that are only a few feet long and do not extend across the entire slab are counted as shrinkage cracks.

Severity Levels: Nonreinforced Slabs

L - Nonfilled* cracks less than or equal to 1/2 in. (12 mm) or filled cracks of any width with the filler in satisfactory condition. No faulting exists.

M - One of the following conditions exists:
1. Nonfilled crack with a width between 1/2 and 2 in (12 and 51 mm).
2. Nonfilled crack of any width up to 2 in. (51 mm) with faulting of less than 3/8 in. (10 mm).
3. Filled crack of any width with faulting less than 3/8 in. (10 mm).

'Filled cracks where filler is unsatisfactory are treated as nonfilled.

H - One of the following conditions exists:

1. Nonfilled crack with a width greater than 2 in. (51 mm).
2. Filled or nonfilled crack of any width with faulting greater than 3/8 in. (10 mm).

Reinforced Slabs

L - Nonfilled cracks with a width of 1/8 to 1 in. (3 to 25 mm); filled crack of any width with the filler in satisfactory condition. No faulting exists.

M - One of the following conditions exists:

1. Nonfilled cracks with a width between 1 and 3 in. (25 mm and 76 mm) and no faulting.
2. Nonfilled crack of any width up to 3 in. (76 mm) with up to 3/8 in. (10 mm) of faulting.
3. Filled crack of any width with up to 3/8 in. (10 mm) faulting.

H - One of the following conditions exists:

1. Nonfilled crack with width over 3 in. (76 mm).
2. Filled or nonfilled crack of any width with faulting over 3/8 in. (10 mm).

How to Count:

Once the severity has been identified, the distress is recorded as one slab. If two medium-severity cracks are within one slab, the slab is counted as having one high-severity crack. Slabs divided into four or more pieces are counted as divided slabs. In reinforced slabs, cracks with a width less than 1/8 in. (3 mm) are counted as shrinkage cracks.

Slabs longer than 30 ft. (9.1 m) are divided into approximately equal length “slabs” having imaginary joints assumed to be in perfect condition.

Options for Repair:

L - Do nothing; Seal cracks over 1/8 in.

M - Seal cracks.

H - Seal cracks; Partial depth patch; Slab replacement.

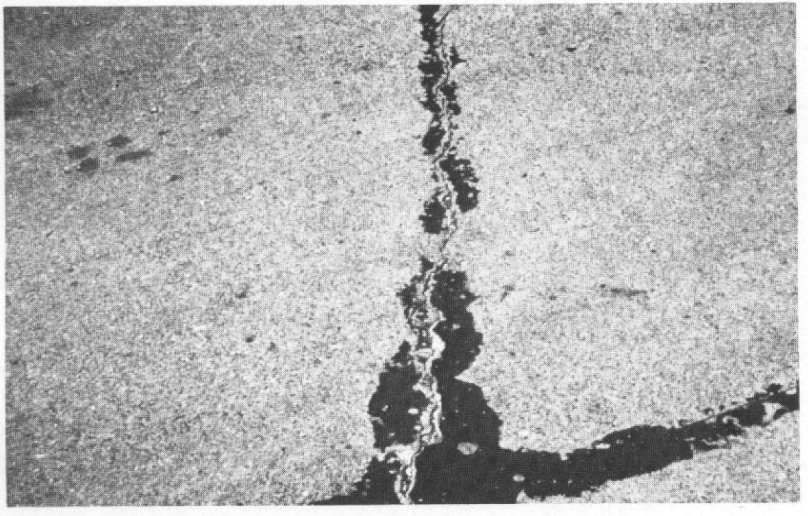

Figure 103. Low-severity linear cracking in a nonreinforced concrete slab.

Figure 104. Low-severity linear cracking in a nonreinforced concrete slab

Figure 105. Medium-severity linear cracking in a reinforced concrete slab

Figure 106. Medium-severity linear cracking in a reinforced concrete slab

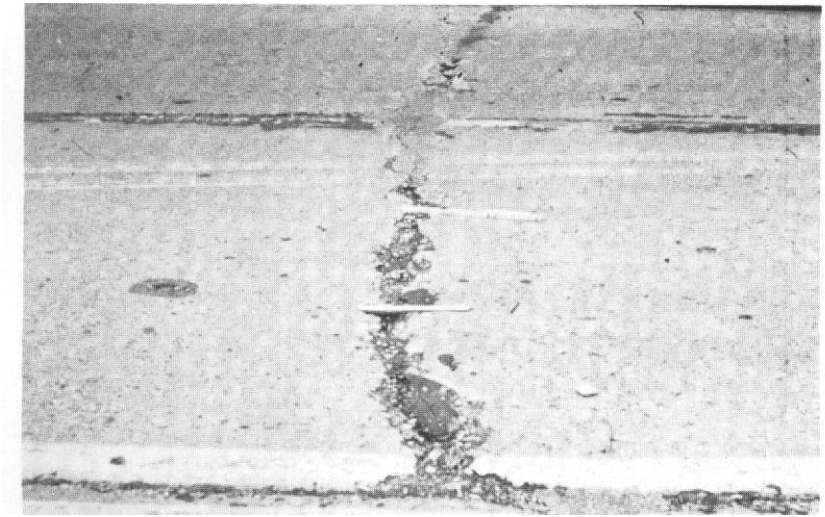

Figure 107. High-severity linear cracking in a nonreinforced concrete slab

Figure 108. High-severity linear cracking in a nonreinforced concrete slab

PATCHING, LARGE [MORETHAN 5 SQ FT (.45 SQ M)] AND UTILITY CUTS

Description: A patch is an area where the original pavement has been removed and replaced by a filler material. A utility cut is a patch that has replaced the original pavement to allow the installation or maintenance of underground utilities. The severity levels of a utility cut are the same as those for regular patching.

Severity Levels:

L - Patch is functioning well, with little or no deterioration. (Figures 109 and 110)

M - Patch is moderately deteriorated and/or moderate spalling can be seen around the edges. Patch material can be dislodged with considerable effort. (Figures 111 through 113)

H - Patch is badly deteriorated. The extent of the deterioration warrants replacement of the patch. (Figure 114)

How to Count:

If a single slab has one or more patches with the same severity level, it is counted as one slab containing that distress. If a single slab has more than one severity level, it is counted as one slab with the higher severity level.

If the cause of the patch is more severe, only the original distress is counted.

Options for Repair:

L - Do nothing.

M - Seal cracks; Replace patch.

H - Replace patch.

Figure 109. Low-severity patching, large and utility cuts

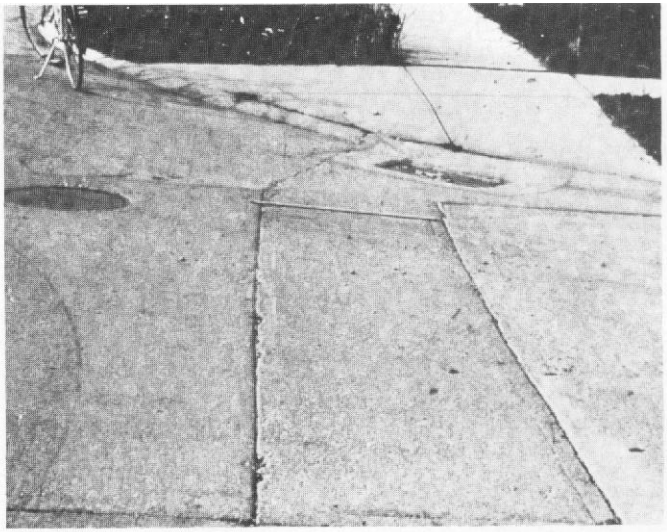

Figure 110. Low-severity patching, large and utility cuts

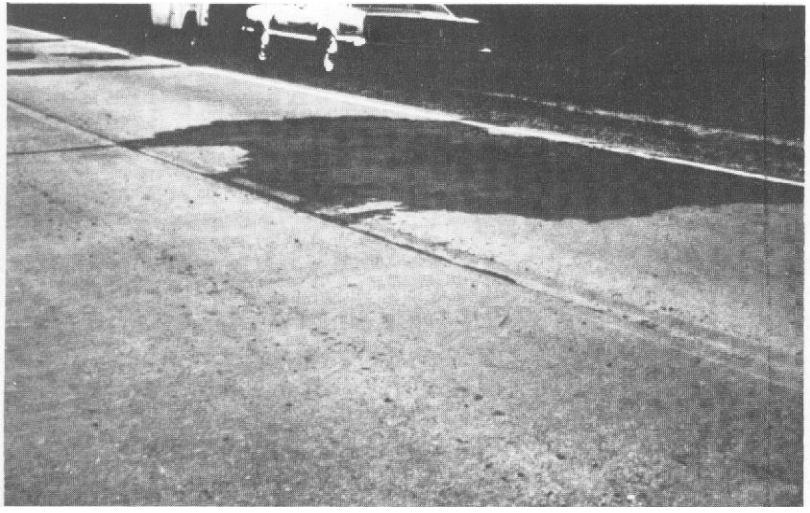

Figure 111. Medium-severity patching, large

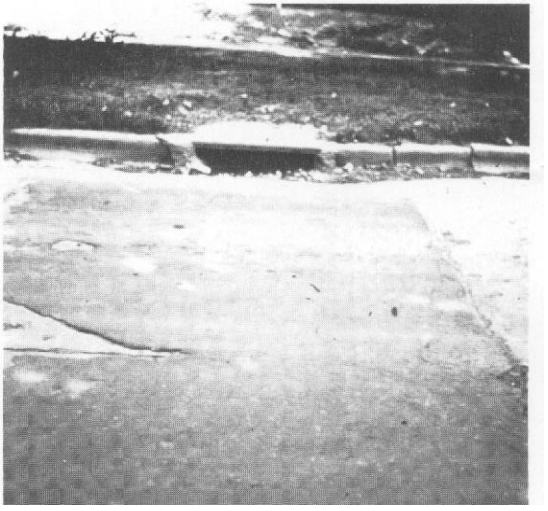

Figure 112. Medium-seventy patching, large

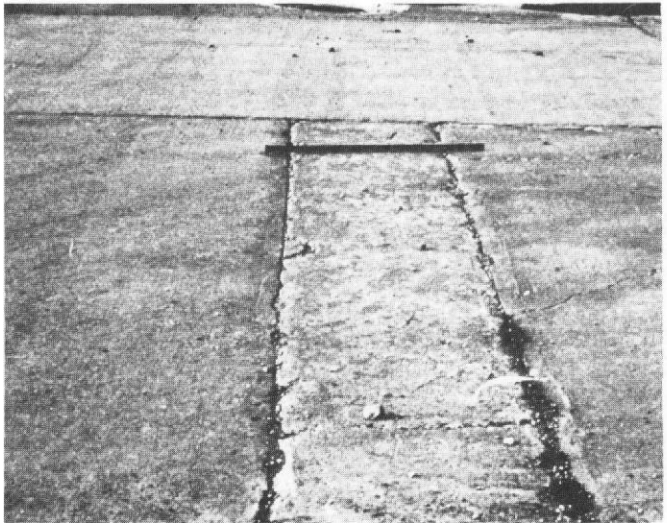

Figure 113. Medium-severity patching. utility cuts

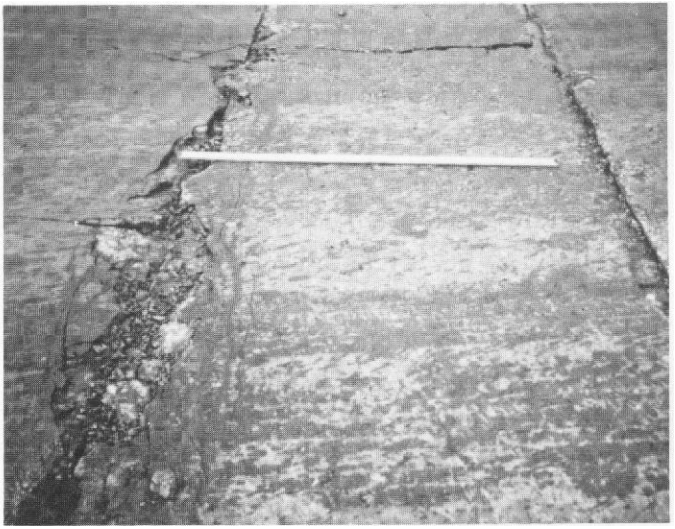

Figure 114. High-severity patching. large

PATCHING, SMALL [LESS THAN 5 SQ FT (.45 SQ M)]

Description: A patch is an area where the original pavement has been removed and replaced by a filler material.

Severity Levels:

L - Patch is functioning well with little or no deterioration. (Figure 115)

M - Patch is moderately deteriorated. Patch material can be dislodged with considerable effort. (Figure 116)

H - Patch is badly deteriorated. The extent of deterioration warrants replacement of the patch. (Figure 117)

How to Count:

If a single slab has one or more patches with the same severity level, it is counted as one slab containing that distress. If a single slab has more than one severity level, it is counted as one slab with the higher severity level.

If the cause of the patch is more severe, only the original distress is counted.

Options for Repair:

L - Do nothing.

M - Do nothing; Replace patch.

H - Replace patch.

Figure 115. Low-severity patching, small

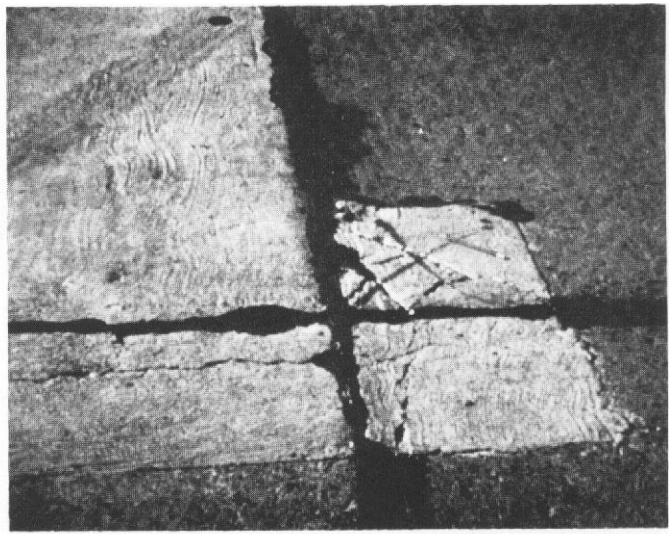

Figure 116. Medium-severity patching. small

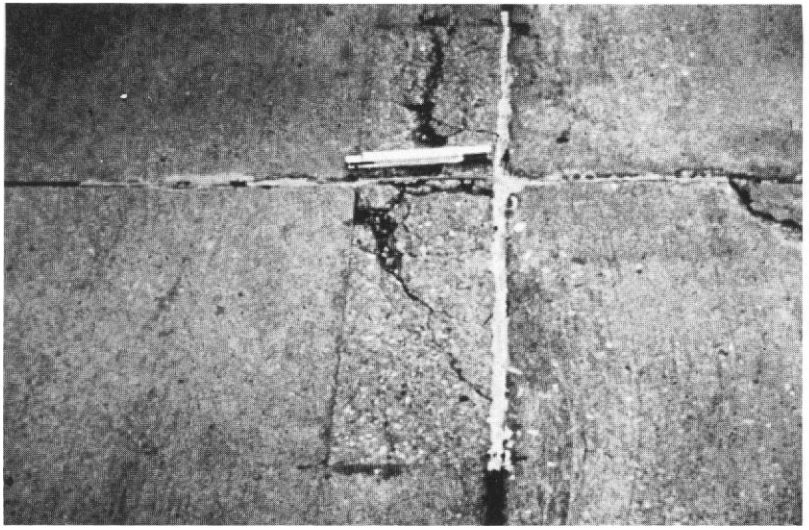

Figure 117. High-severity patching, small

POLISHED AGGREGATE

Description: This distress is caused by repeated traffic applications. When the aggregate in the surface becomes smooth to the touch, adhesion with vehicle tires is considerably reduced. When the portion of aggregate extending above the surface is small, the pavement texture does not significantly contribute to reducing vehicle speed. Polished aggregate should be counted when close examination reveals that the aggregate extending above the concrete is negligible, and the surface aggregate is smooth to the touch. This type of distress is indicated when the number on a skid resistance test is low or has dropped significantly from previous ratings.

Severity Levels: No degrees of severity are defined. However, the degree of polishing should be significant before it is included in the condition survey and rated as a defect. (Figure 118)

How to Count: A slab with polished aggregate is counted as one slab.

Options for Repair: Groove surface; Overlay.

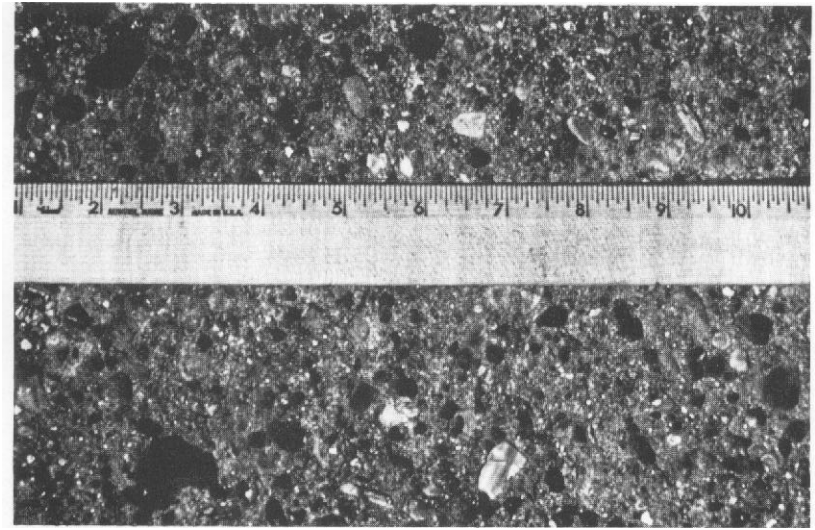

Figure 118. Polished aggregate

POPOUTS

Description: A popout is a small piece of pavement that freeze-thaw action combined with aggregate expansion causes to break loose from the surface. Popouts usually range in diameter from approximately 1 to 4 in. (25 to 102 mm) and in depth from 1/2 to 2 in. (13 to 51 mm).

Severity Levels: No degrees of severity are defined for popouts. However, popouts must be extensive before they are counted as a distress. Average popout density must exceed approximately three popouts per square yard over the entire slab area. (Figure 119)

How to Count: The density of the distress must be measured. If there is any doubt that the average is greater than three popouts per square yard, at least three random 1 sq yd (.84 meters squared) areas should be checked. When the average is greater than this density, the slab should be counted.

Options for Repair: Do nothing.

32 Popouts

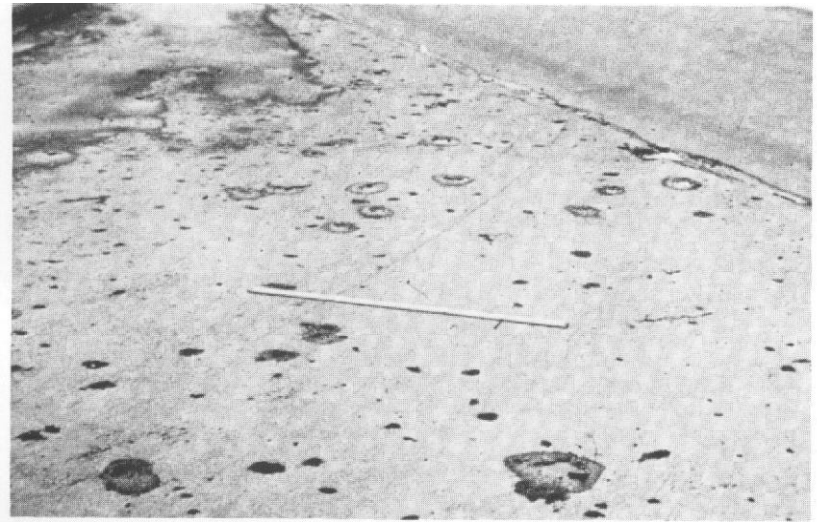

Figure 119. Popouts

PUMPING

Description: Pumping is the ejection of material from the slab foundation through joints or cracks. This is caused by deflection of the slab by passing loads. As a load moves across the joint between the slabs, water is first forced under the leading slab, and then forced back under the trailing slab. This erodes and eventually removes soil particles, resulting in progressive loss of pavement support. Pumping can be identified by surface stains and evidence of base or subgrade material on the pavement close to joints or cracks. Pumping near joints is caused by poor joint sealer and indicates loss of support; repeated loading will eventually produce cracks. Pumping can also occur along the slab edge, causing loss of support.

Severity Levels: No degrees of severity are defined. It is sufficient to indicate the pumping exists. (Figures 120 and 121)

How to Count: One pumping joint between two slabs is counted as two slabs. However, if the remaining joints around the slab are also pumping, one slab is added per additional pumping joint.

Options for Repair: Underseal, joint and crack seal, and restore load transfer.

Figure 120. Pumping

Figure 121. Pumping

PUNCHOUT

Description: This distress is a localized area of the slab that is broken into pieces. The punchout can take many different shapes and forms, but it is usually defined by a crack and a joint, or two closely spaced cracks [usually 5 ft (1.52 m) wide]. This distress is caused by heavy repeated loads, inadequate slab thickness, loss of foundation support, and/or a localized concrete construction deficiency (e.g., honeycombing).

Severity Levels:

	Majority of Cracks	Number of Pieces	
Severity	2 to 3	4 to 5	>5
L	L	L	M
M	L	M	H
H	M	H	H

See Figures 122 through 124.

How to Count: If a slab contains one or more punchouts, it is counted as containing a punchout at the severity level of the most severe punchout.

Options for Repair:

L - Do nothing; Seal cracks

M - Full depth patch.

H - Full depth patch.

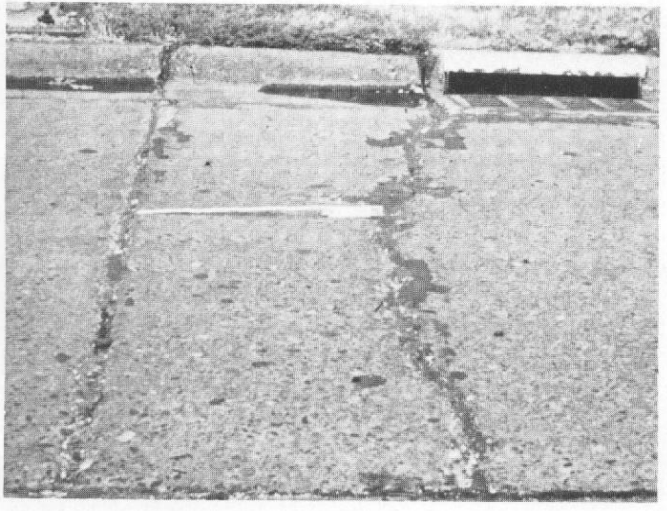

Figure 122. Low-severity punchout

Figure 123. Medium-severity punchout approaching high severity

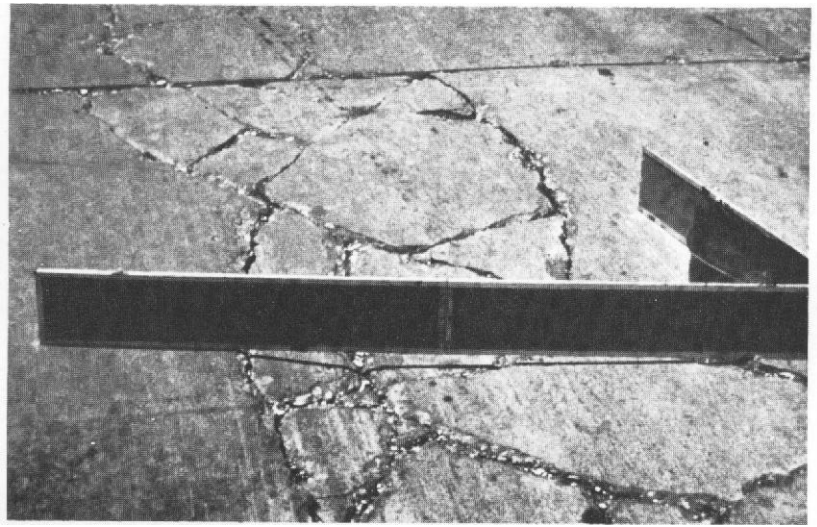

Figure 124. High-severity punchout

RAILROAD CROSSING

Description: Railroad crossing distress is characterized by depressions or bumps around the tracks.

Severity Levels:

L - Railroad crossing causes low-severity ride quality. (Figure 125)

M - Railroad crossing causes medium-severity ride quality. (Figure 126)

H - Railroad crossing causes high-severity ride quality (Figure 127)

How to Count: The number of slabs crossed by the railroad track is counted. Any large bump created by the tracks should be counted as part of the crossing.

Options for Repair:

L - Do nothing.

M - Partial depth patch approach; Reconstruct crossing.

H - Partial depth patch approach; Reconstruct crossing.

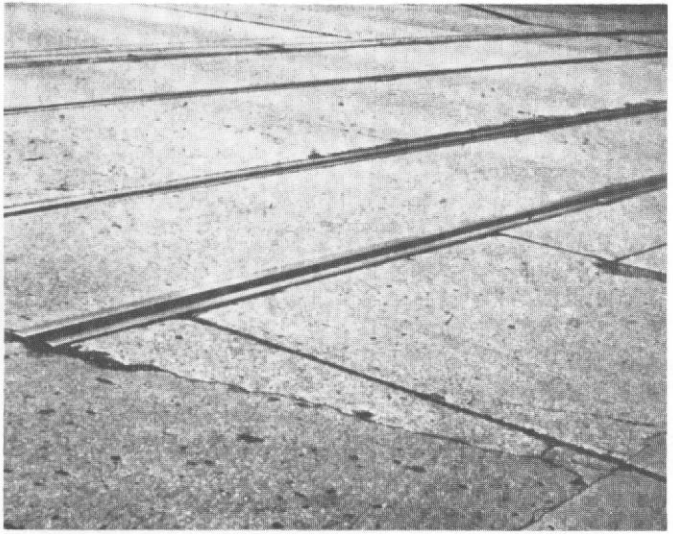

Figure 125. Low-severity railroad crossing

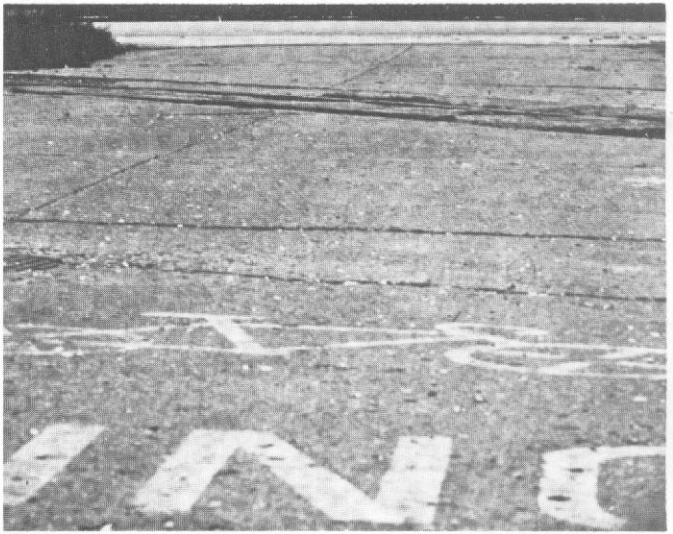

Figure 126. Medium-severity railroad crossing

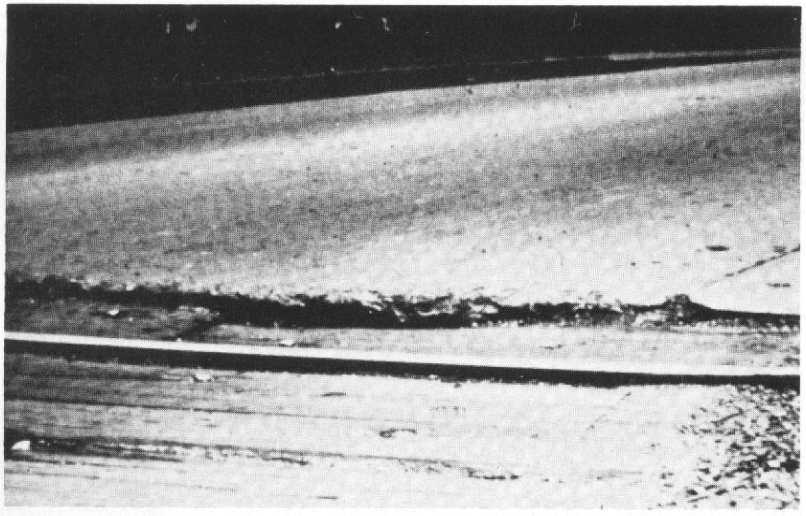

Figure 127. High-severity railroad crossing

SCALING/MAP CRACKING/CRAZING

Description: Map cracking or crazing refers to a network of shallow, fine, or hairline cracks which extend only through the upper surface of the concrete. The cracks tend to intersect at angles of 120 degrees. Map cracking or crazing is usually caused by concrete overfinishing, and may lead to surface scaling, which is the breakdown of the slab surface to a depth of approximately 1/4 to 1/2 in. (6 to 13 mm). Scaling may also be caused by deicing salts, improper construction, freeze-thaw cycles, and poor aggregate. The type of scaling defined here is not caused by "D" cracking. If scaling is caused by "D" cracking, it should be counted under that distress only.

Severity Levels:

L - Crazing or map cracking exists over most of the slab area; the surface is in good condition, with only minor scaling present. (Figure 128)

M - Slab is scaled, but less than 15 percent of the slab is affected. (Figure 129)

H - Slab is scaled over more than 15 percent of its area. (Figures 130 through 132)

How to Count: A scaled slab is counted as one slab. Low-severity crazing should only be counted if the potential for scaling appears to be imminent, or few small pieces have come out.

Options for Repair:

L - Do nothing.

M - Do nothing; Slab replacement.

H - Partial or full depth patch; Slab replacement; Overlay.

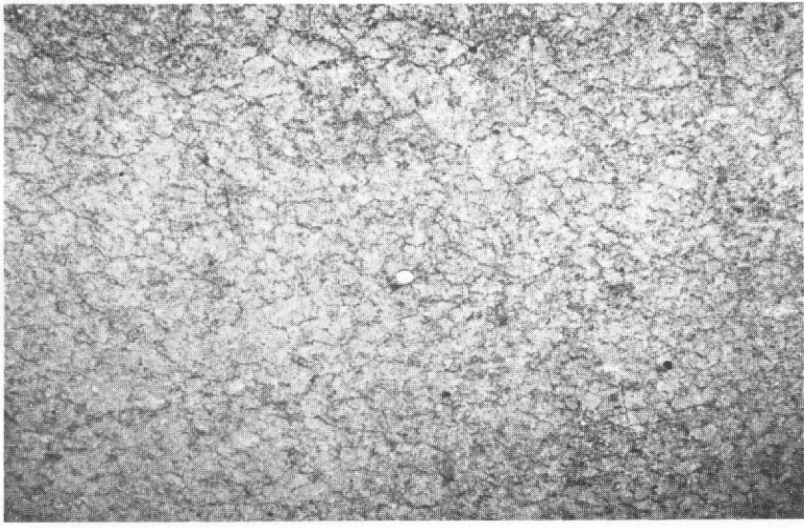

Figure 128. Low-severity scaling/map cracking/crazing

Figure 129. Medium-severity scaling/map cracking/crazing

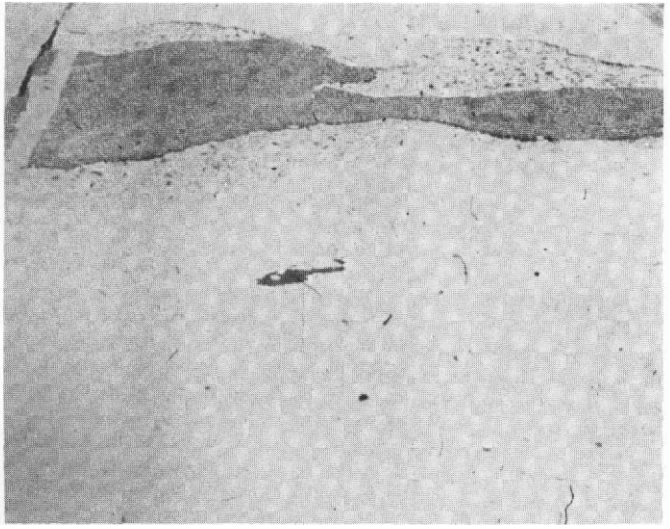

Figure 130. High-severity scaling/map cracking/crazing

Figure 131. High-severity scaling/map cracking/crazing

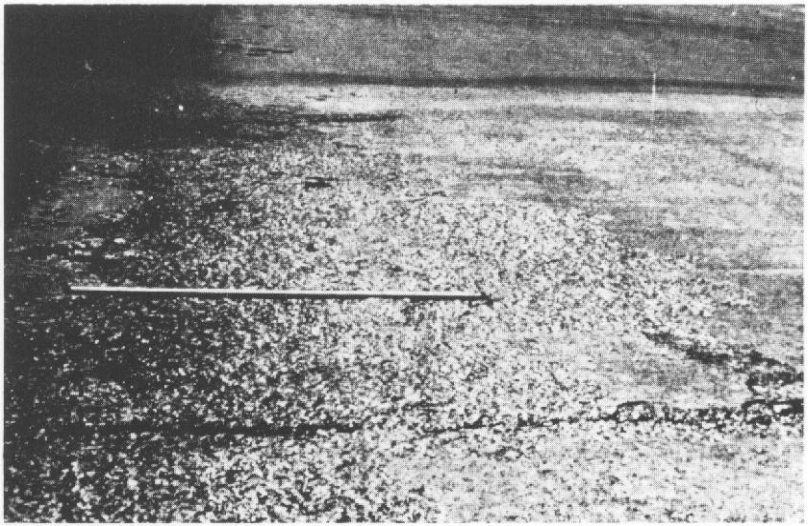

Figure 132. High-severity scaling/map cracking/crazing

SHRINKAGE CRACKS

Description: Shrinkage cracks are hairline cracks that are usually only a few feet long and do not extend across the entire slab. They are formed during the setting and curing of the concrete and usually do not extend through the depth of the slab.

Severity Levels: No degrees of severity are defined. It is enough to indicate that shrinkage cracks are present. (Figure 133)

How to Count: If one or more shrinkage cracks exist on one particular slab, the slab is counted as one slab with shrinkage cracks.

Options for Repair: Do nothing.

37 Shrinkage

Figure 133. Shrinkage cracks

SPALLING, CORNER

Description: Corner spalling is the breakdown of the slab within approximately 2 ft (.6 m) of the corner. A corner spall differs from a corner break in that the spall usually angles downward to intersect the joint, while a break extends vertically through the slab corner. Spalls less than 5 in. (13 mm) from the crack to the corner on both sides should not be counted.

Severity Levels:

Corner Spalling

Depth of Spall	Dimensions of Sides of Spall 5 x 5 in. to 12 x 12 in. (13 x 13 mm) (31 x 31 mm)	Over 12 x 12 in (31 x31 mm)
<1 in. (25 mm)	L	L
>1 to ≤2 in. (>25 to ≤51 mm)	L	M
>2 in. (51 mm)	M	H

Corner spalling having an area of less than 10 sq in. (516 millimeters squared) is not counted. (Figures 134 through 137)

How to Count: If one or more corner spalls with the same severity level are in a slab, the slab is counted as one slab with corner spalling. If more than one severity level occurs, it is counted as one slab with the higher severity level.

Options for Repair:

L - Do nothing.

M - Partial depth patch.

H - Partial depth patch.

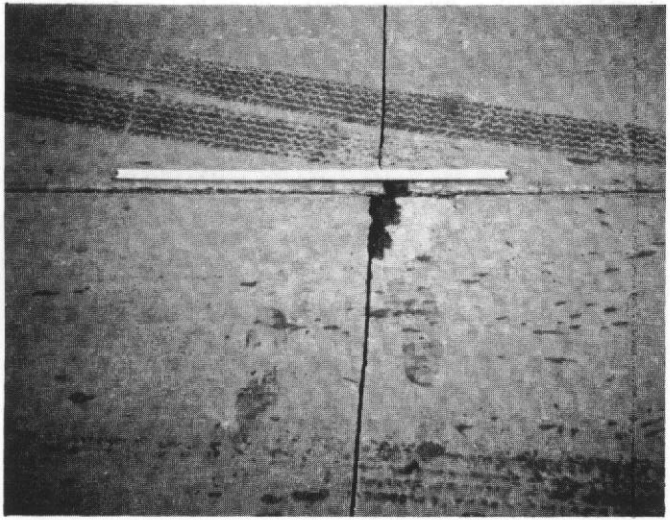

Figure 134. Low-severity spalling, corner

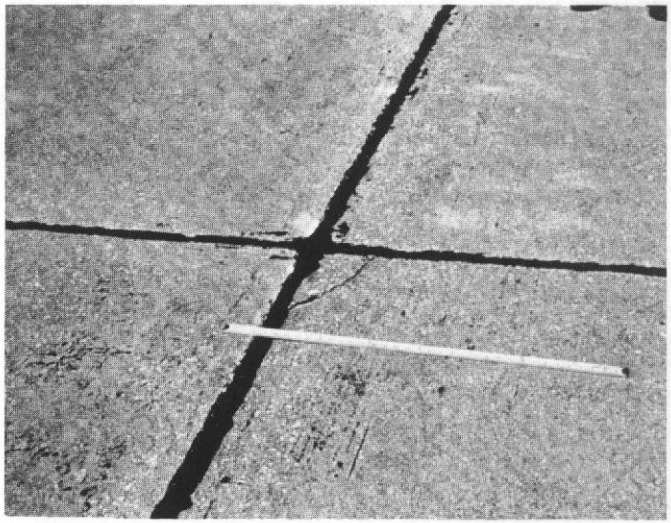

Figure 135. Low-severity spalling, corner

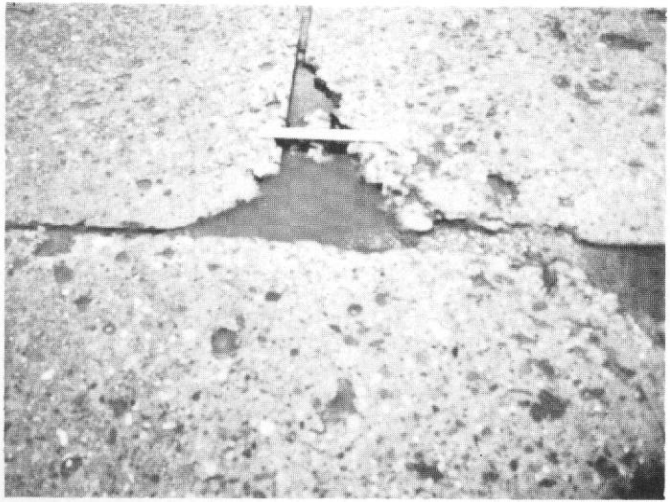

Figure 136. Medium-severity spalling, corner

Figure 137. High-severity spalling, corner

SPALLING, JOINT

Description: Joint spalling is the breakdown of the slab edges within 2 ft (.6 m) of the joint. A joint spall usually does not extend vertically through the slab, but intersects the joint at an angle. Spalling results from:

1. Excessive stresses at the joint caused by traffic loading or by infiltration of incompressible materials.

2. Weak concrete at the joint caused by overworking.

3. Water accumulation in the joint and freeze-thaw action.

Severity Levels:

Joint Spalling

Spall Pieces	Width of Spall	Length of Spall <2 ft (.6 m)	Length of Spall >2 ft (.6 m)
Tight-cannot be easily removed (may be a few pieces missing)	≤4 in. (102 mm)	L	L
	>4 in. (102 mm)	L	L
Loose - can be removed and some pieces are	≤4 in. (102 mm)	L	M

missing; if most or all pieces are missing, spall is shallow, less than 1 in. (25 mm)	>4 in. (102 mm)	L	M
Missing - most or all pieces have been removed	<4 in. (102 mm)	L	M
	>4 in. (102 mm)	M	H

See Figures 138 through 140.

A frayed joint where the concrete has been worn away along the entire joint is rated as low severity.

How to Count: If the spall is along the edge of one slab, it is counted as one slab with joint spalling. If spalling is on more than one edge of the same slab, the edge having the highest severity is counted and recorded as one slab. Joint spalling can also occur along the edges of two adjacent slabs. If this is the case, each slab is counted as having joint spalling.

Options for Repair:

L - Do nothing.

M - Partial depth patch.

H - Partial depth patch; Reconstruct joint.

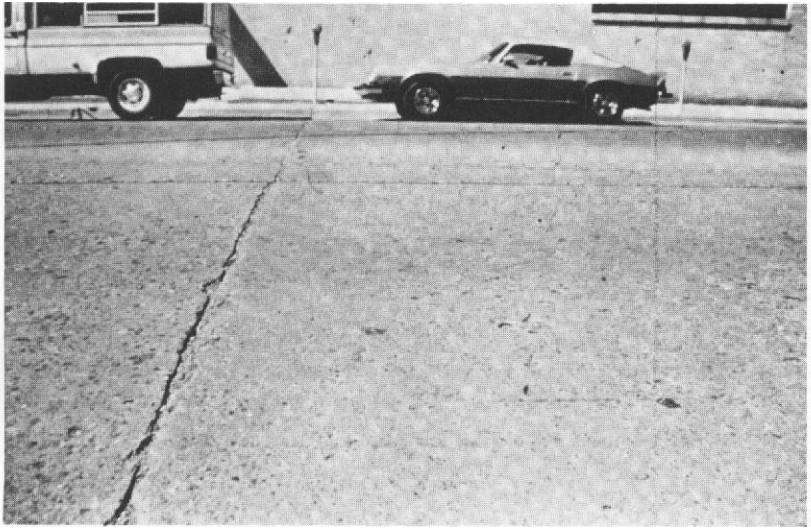

Figure 138. Low-severity spalling, joint

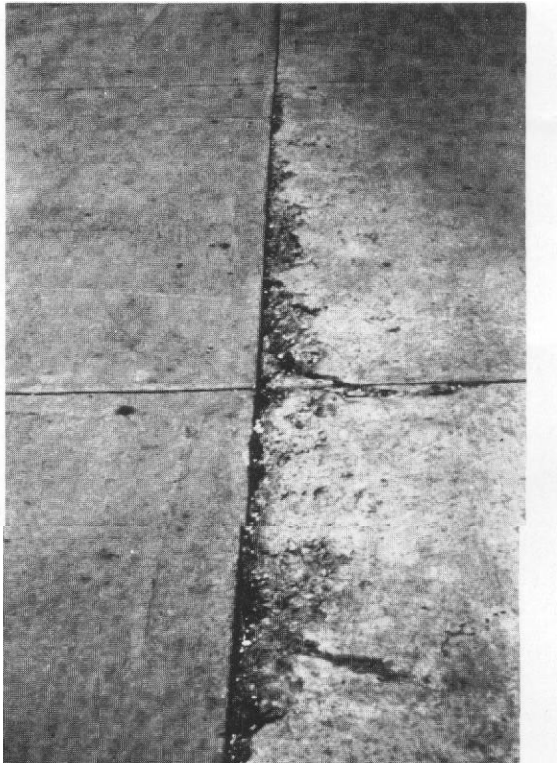

Figure 139. Medium-severity spalling, joint

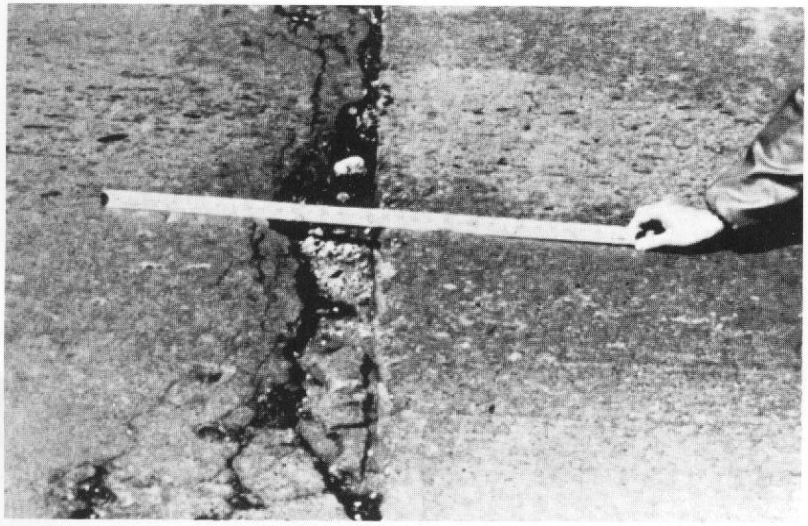

Figure 140. High-severity spalling, joint

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